

Application of participatory design to development of organic farming game based on the philosophy of sufficiency economy

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Abstract

This study aimed to: 1) explore the Philosophy of Sufficiency Economy and the participatory design for developing the organic farming life simulation game; 2) develop the organic farming life simulation game based on the Philosophy of Sufficiency Economy; and 3) evaluate the functional quality of the prototype simulation game. In this study, the researcher focused on the literature review on the related documents and supportive theories through the theoretical framework of Human-Centre Design (HCD) that primarily emphasizes the stakeholder's benefits. The researcher also gave deeper attention on the procedure and background context of the supportive theories in order to construct the research conceptual framework and another theory applied in this study was the Participatory Design (PD). The document data was deducted from the literature review and the field data for the game content was derived from the expert and the sample group including: 1) the organic farmers; 2) the agriculturists; and 3) the agricultural administrative and the sample group from Khon Kaen Vocational College divided into 28 vocational certificate students and 32 high vocational certificate students. In term of the user's need for the game design, the data was analyzed and interpreted to define the final result for the desired content and other feature designs for the organic farming game following the Philosophy of Sufficiency Economy and this final result was used to create the game through the Game Design Document Outline (GDD). Then, the data set derived from the final result was used to design the game to be evaluated with the 5-point rating scale evaluation by 5 media experts and 100 students from Khon Kaen Vocational College. The outcome indicated that the quality of the game was good ($\bar{x} = 3.93$, S.D. = 0.45) and when comparing with the standard mean initially defined at 3.51, it was higher so that the game was ensured to be applicable for practical use.

Keywords: Organic Farming; Philosophy of Sufficiency Economy; Life Simulation Game; Participatory Design *PD

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1. Introduction

Nowadays, the Office of the Vocational Education Commission (VEC) has issued a policy for the school administrators and teachers in both government and private vocational schools to use the Philosophy of Sufficiency Economy as learning management guideline to improve the knowledgeable and smart youth [1] and to support the 12th National Economic and Social Development Plan (2017 – 2021) under Thai Government that has shifted from traditional agriculture to modern agriculture with the effective management system and high technology use following the key concept that the farmers should be wealthier and ready for becoming an entrepreneur [2]. Additionally, this

can be a way of applying the Philosophy of Sufficiency Economy from the late King Rama IX who wants his people to depend on the moderate practice with self-consciousness that will guide the right path for the Thai citizens. In conclusion, the “Philosophy of Sufficiency Economy is to live moderately and after ones are satisfied with what they have, they may look for more but those things should be received rightfully [3]”.

Today, the advanced science and technology was broadly used for the agricultural purpose in order to increase the agricultural productivity such as chemicals so that the farmers can produce sufficient materials for the industrial factories while they can reduce their energy consumption. The consequence of the synthetic substance use causes a number of problems including the environmental degradation, loss, and debt. It also leads to the economic failure since the inconsistency between high production cost and low crop price as well as negative effects on the farmer’s and consumer’s health in which this chemicals was somehow absorbed into their bodies. Also, this harmful chemicals negatively affects the local environment and ruins the subsistence farming resources for Thai farmers [4]. Indeed, this is a good start that reminds both Thai farmers and the farmers around the world of organic farming in which the agricultural production is friendlier to the environment, balance of the nature, and biodiversity and the ecological management is designed to be mostly similar to the nature in which organic matter is used for the soil improvement and enrichment. Accordingly, the product of organic farming is nontoxic for farmers and consumers as well and it causes none of environment degradation [5]. On this matter, the Ministry of Agriculture and Cooperatives is determined to promote and improve the positive image of the Thai organic product and service to the world’s recognition while the world marketing trend has recently shifted its focus on organic products. Consequently, Thailand is working on the plan to push forward the local organic products into the world’s market as well as to present “Thailand as the hub of the international organic production and consumption” [6].

Presently, the mostly popularly used device for communication is smartphone since it is able to connected to the internet with an access to the information, movies or music, and online and offline games. Smartphone also has a very convenient function called “Application” or a software that work on mobile phone and tablet. Hence, the appropriate use of this technology to expand the learning extent has recently become a new channel that completely makes it easier to reach for knowledge [7]. Particularly, Life Simulator is likely a game application that simulates the content from real situation with the purpose to develop the user’s skill to match each of different quests such as flight simulator or driving simulator in which a theory of Participatory Design (PD) [8] is adapted in order to allow the stakeholders to participate in the designing step to share their needs to create the game together.

From the abovementioned, the researcher was interested in designing and developing the game to provide knowledge on organic farming based on the integrated theoretical framework between the Philosophy of Sufficiency Economy and Participatory Design (PD). This game aimed to present the knowledge of organic farming with care for the environment and natural balance while the ecological management system was similar to the natural system. This game also aimed to remind the user of the significance of the Philosophy of Sufficiency Economy.

2. Materials and Methods

Research objectives

- 1) To explore the Philosophy of Sufficiency Economy and the participatory design for the development of the organic farming simulation game
- 2) To develop the life simulation game to present the organic farming following the Philosophy of Sufficiency Economy
- 3) To evaluate the quality of the prototype simulation game

The research processes

In this study, the researcher adapted the Human-Centre Design (HCD) and Participatory Design (PD) as the core of the learning media development and design. The research method was comprised of 6 phases as follows.



Fig. 1 Theoretical Framework of Human-Centred Design (HCD)

Phase 1: Literature Review - The researcher studied and identified the suitable content of organic farming and the Philosophy of Sufficiency Economy to construct the conceptual framework for a systematic development of the prototype game.

Phase 2: Data Collection - The researcher assembled the related data from the in-depth interview with the stakeholders involved in the media development and design. These people were divided into 2 groups: 1) 5 Experts; and 2) 60 participants from the sample group from Khon Kaen Vocational College.

Phase 3: Data Analysis – the data derived from the in-depth interview with the experts and sample group was analyzed and summarized systematically to define the designing and developing framework for the prototype game.

Phase 4: Learning Media Design and Development – the result from data analysis was used to identify the relationship from the triangulation of sources in order to validate the accuracy and reliability of data analysis and synthesis following the Game Design Document Outline (GDD).

Phase 5: Learning Media Quality Evaluation by the Experts – The prototype game quality was evaluated by the media expert using the 5-point rating scale evaluation on 3 issues: 1) Content; 2) Design; and 3) User's Interface

Phase 6: Revision and Finalization – The final step was to revise the prototype game following the expert's feedback and suggestions and to develop the final product of the life simulation game to try out with the sample group.

Population and sample group

The sample group was classified into 3 groups of people as follows.

Group 1: The sample group for the field data collection or the expert group: 2 organic farmers, 1 agriculturist, and 1 agricultural administrator. These people were selected by purposive sampling.

Group 2: The sample group for the media designing data collection: 28 vocational certificate students from 14 programs and 32 high vocational certificate students from 16 programs. These students were selected by cluster sampling.

Group 3: The experimental group for the game quality evaluation including a group of 6 experts: including 2 game design experts, 2 organic farming experts, and 2 experts in Philosophy of Sufficiency Economy. These experts were chosen by purposive sampling; and a group of 100 students from totally 3,878 students in Khon Kaen Vocational College (Taro Yamane, 1967).

Research tools

- 1) The in-depth interview form for the experts
- 2) The survey form on the user's need for the game design
- 3) The life simulation game on "Organic Farming Following the Philosophy of Sufficiency Economy"
- 4) The game quality evaluation form on the life simulation game for the experts
- 5) The game quality evaluation form on the life simulation game for the sample group

Statistics used in research

The researcher divided the data analysis into 2 phases using different statistical approaches as described below.

Phase 1 (Qualitative Data): the researcher used a content analysis technique to analyze the data that was classified from the keywords including the literature review on the related document and supportive theories regarding the Philosophy of Sufficiency Economy. The data sets deducted from the related document, the interview with the experts, and the user's need for the game design from the sample group was analyzed and resulted as percentage that compared between the frequency of desired data and the frequency of total data (100%).

Phase 2 (Quantitative Data): The quantitative data was processed through a numerical analysis to perform the Usability Test with 5-point rating scale to statistically evaluate the game quality. The question item covered 3 issues: Content, Design, Animation, and Sound in which the rating score was classified into 5 levels for each set of question items for those 3 issues. The mean and standard deviation, the fluently used central values, represented the total data divided by the data number. The standard deviation score was the average of all data sets which were different from the mean.

The 5-point rating scale evaluation

| Mean | Interpretation |
|------------|-------------------|
| 4.51-5.00 | Very High Quality |
| 3.51-4.50 | Good quality |
| 2.51-3.50 | Moderate quality |
| 1.51-2.50 | Low Quality |
| 1.00 -1.50 | Very Low Quality |

3. Results and Discussion

In this study, the researcher intently looked at the related documents and theories that could be discussed and divided into 2 sections as below.

Section 1: Qualitative Research – it was an adaptation of the Participatory Design (PD) theory to assemble the data from the experts and the sample group. The selected data was later interpreted one by one until the final result could be defined. So, the content and design of the prototype game could be described in 2 key points as follows.

Key Point 1: According to the investigation on the Philosophy of Sufficiency Economy, the sustainable and balanced development to cope with the possible changes in several contexts including economy, society, environment, knowledge, and technology should be consistent with the concept of organic farming that requires none of synthetic chemicals since it may cause contamination in soil, water, and animals [9]. On this matter, organic farming should typically care for the human's health in 4 concerns: Health, Ecology, Justice, and Care [10]; meanwhile, it should be considerate for the nutrient circulation, the soil enrichment, the balanced relationship among a variety of creatures, the agro-ecological conservation and recovery, dependence on natural mechanism, and self-dependence for agricultural input [11] in which the organic farming standard is set as the basic practices that all farmers are required to follow while a certifying organization will use this standard to evaluate and decided if any farm could be certified as a standard farm [12].

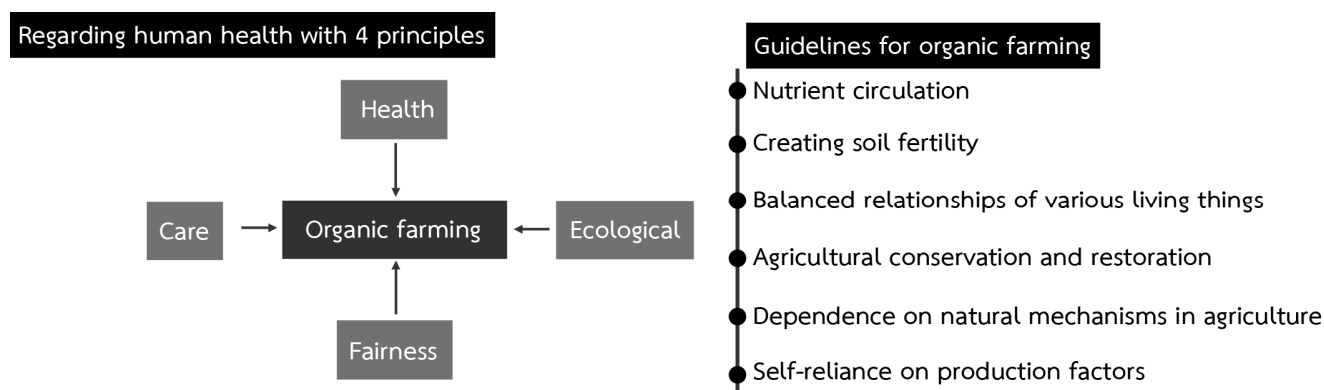


Fig. 2 Organic Farming Principle

Key Point 2: The agricultural data from the experienced farmers indicated that to achieve a successful organic farming, an individual requires correct information and constantly learning to become proficient and well-prepared to make a protection plan for toxic contamination in the air and water as well as to make an effective soil management plan and to use organic fertilizer to maintain the natural balance; the GMO plants are forbidden. Therefore, both animals and plants are 100% chemical-free. Besides, the soil enrichment is required because the fertilized soil will be favorable for planting so that the farmer could earn sufficiently while they could learn to be self-dependent. The farmers should also be implanted with good sense and awareness of doing organic farming based on the consumer's safety. Similarly, all related government organizations should seriously provide more knowledge regarding organic farming, production and selling process, product processing, and productive innovation. For example, selling should present a story and quality. All of the abovementioned will help creating the sustainable and happy organic farming.

Game Design Document Outline (GDD)

The researcher investigated to find the desired content concerning organic farming and the Philosophy of Sufficiency Economy and later systematically summarized the data. This summarized

data was used to define the guideline for the game design and production via the procedure of Game Design Document Outline (GDD) and it was firstly resulted as a game draft. Thus, all required information for the game design was completely discussed in this step such as Game Title, Game Overview, Game Concept, Game Genre, Game play and Mechanics, Game play, Mission/challenge Structure, Story and Character, Levels Design, Graphic Game Art, and Game Development. All of these were created and developed via the Unity software since the researcher intended to create an offline game to work on the android smartphones.



Fig. 3 Game Interface

(1) *User's Name Bar* that shows a user's name logged in before entering the game, (2) *User's Experience Bar (EXP)* to remind the user of which level they are at and how many levels they have to go for the next level, (3) *Income Bar* to indicate the money earned from farming, (4) *Mission Bar* that shows the number of product that had been produced and if the product was enough to complete the mission at each level, (5) *Sounds Menu* to turn on and turn of the sound, (6) *Construction Bar* for the user to choose what building or tree to be created in the farm, and (7) *How-To Bar* to show the instruction for the user to understand how to play.

As previously discussed, the researcher could summarize the knowledge body from the experts and the sample group as the stakeholders of the life simulation game for organic farming based on the "Participatory Design (PD)" theory and used it to define the guideline to develop the graphic for in which the collected data, the expert's suggestions, and the needs for the desired game design from the sample group were used to revise and finalize the life simulation game entitled "Organic Farming Game" based on the Participatory Design (PD) theory.

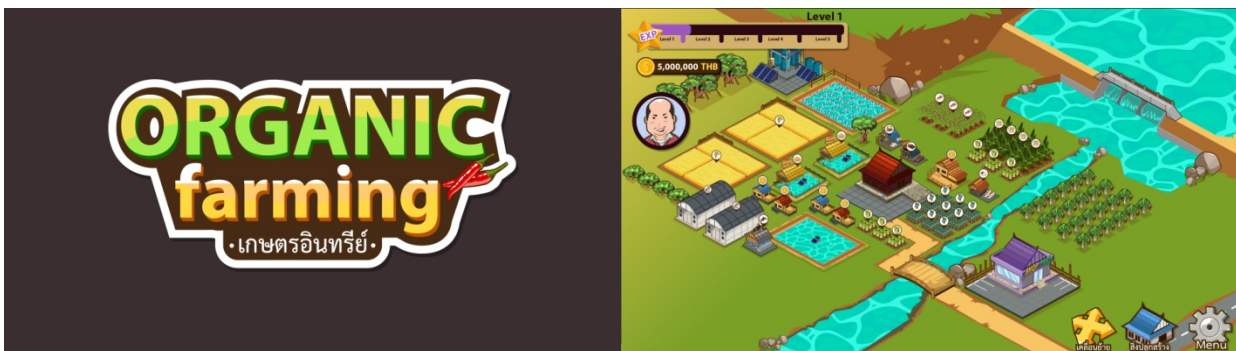


Fig. 4 Prototype of Organic Farming Game



Fig. 5 Buildings and Trees in Organic Farming Game

Game Development

The data sets of graphic game arts designed via Adobe Illustrator from all the Game Design Document Outline (GDD) were developed by Unity because the researcher wished to create the game that can work offline for the classroom where Wi-Fi might be unavailable in order to keep the learner continually gain their knowledge with fun.

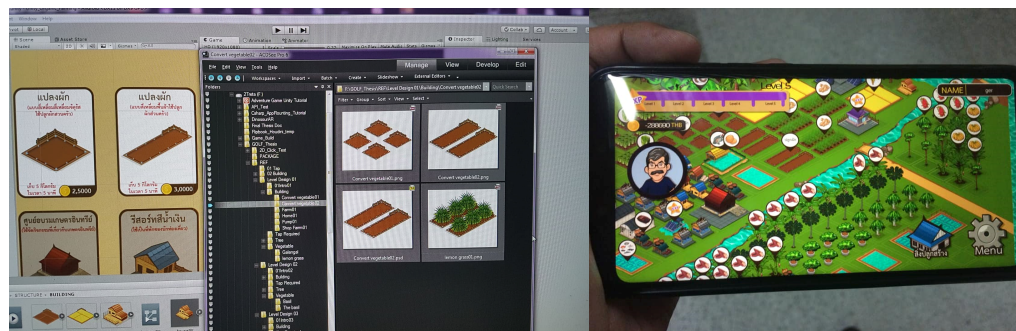


Fig. 6 Game Development via Unity

Section 2: Quantitative Research – this was the use of the data set to create the Game Design Document Outline (GDD) and develop the life simulation game based on the Philosophy of Sufficiency Economy. The game was evaluated with the 5-point rating scale evaluation.

Table 1 Evaluation Result of Organic Farming Game

| Topics | \bar{x} | S.D. | EVALUATION SCORE |
|--------------|-----------|------|---------------------|
| Experts | 4.00 | 0.33 | Good Quality |
| Sample Group | 3.86 | 0.97 | Good Quality |
| Total | 3.93 | 0.45 | Good Quality |

As a result, it was confirmed that the quality of the game was good ($\bar{x} = 3.93$, S.D. = 0.45) which was higher than the standard mean previously defined at 3.51. Accordingly, this Organic Farming Game was firmly applicable for practical use.

4. Conclusion

The study on “Application of Participatory Design to Development of Organic Farming Game Based on the Philosophy of Sufficiency Economy” was intently conducted to develop the prototype game that presents the content on organic farming with an implication of the Philosophy of Sufficiency Economy so that the user can enjoy while learning about organic farming. Particularly, the research framework of this study was based on Human-Centred Design (HCD) while the Participatory Design theory was used as the conceptual framework to improve the research method in which the needs for the desired game design suggested by the experts and the sample group (the stakeholders) could be engaged into the process of game design and development through the Game Design Document Outline (GDD). Additionally, the quality evaluation on Organic Farming Game revealed that the total evaluation score rated by the experts was good ($\bar{x} = 4.00$, S.D. = 0.33) but they recommended that: a user’s guidebook and instruction should be provided; the object-up was too small and difficult for reading so it needs to be enlarged; the Exp-ons function should be revised level by level since the graphic obstructs the trees so the crops could not be harvested; the objects on should be revised to be removable or deleted in the needs of rearranging and editing the EXP value for the level-up. For the evaluation on Organic Farming Game by the sample group, it was found that the total score was good ($\bar{x} = 3.86$, S.D. = 0.97) suggesting that could motivate their attention toward organic gaming and the Philosophy of Sufficiency Economy since the students could enjoy while learning the content of . This positive outcome was ensured by the total evaluation score showing good quality of the game and it assured that this game was applicable for practical implementation.

5. Suggestions

The researcher received the useful suggestions from both the experts and the sample group which were the stakeholders of this study. They suggested that: guidebook and instruction should be provided for reading so the user could understand more and play the game correctly; the object-up function should be easier for reading; the Exp-ons should be developed level by level for those 5 levels so they could be simply understandable for the user; and the objects should not be only deleted but also movable for convenient rearrangement while a user was playing the game. Furthermore, if the game concept and practice could be clearly defined for the user, the game content would be more complete and provide more benefits for practical implementation in the future.

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